

Patent claims:

1 1. A method for determining the distance between two
2 transmitting and receiving stations, which communicate with
3 each other by transmitting data telegrams comprising at
4 least one data bit, characterized in that

5 at least three data telegrams are transmitted alternately
6 between the transmitting and receiving stations

7 to each data bit of the at least three data telegrams
8 during reception of the data telegram concerned a counter
9 value (C_{Ai} , C_{Bi}) is allocated, which corresponds to the
10 counter state of a free-running counter (MC) at the time of
11 reception of the respective data bit,

12 to each of the at least three data telegrams a counter
13 sum (S_1 , S_2 , S_3 , ... S_j) is allocated, which corresponds to
14 the sum or the average value of the counter values (C_{Ai} , C_{Bi})
15 determined during reception of the data telegram concerned,

16 and a sum number (S_s) is formed by weighted summation of
17 the counter sums (S_1 , S_2 , S_3 , S_4) as an indicator of the
18 distance between the transmitting and receiving stations.

1 2. A method according to claim 1, characterized in that for
2 determining the sum number (S_s) the counter sums (S_1 , S_2 ,
3 S_3 , ..., S_j) are weighted with a binominal coefficient which
4 corresponds to their sequence.

1 3. A method according to claim 1 or 2, characterized in
2 that information on the counter sums (S_1 , S_3) determined in
3 the one transmitting and receiving station are transmitted

4 as data telegrams to the other transmitting and receiving
5 station.

1 4. A method according to one of the preceding claims,
2 characterized in that four data telegrams are evaluated for
3 determining the distance.

1 5. A method according to one of the preceding claims,
2 characterized in that the data telegrams comprise the same
3 number of data bits.

1 6. A method according to one of the preceding claims,
2 characterized in that between the transmitted data
3 telegrams a pause of a given duration is observed.

1 7. A transmitting and receiving station for carrying out
2 the method according to one of the preceding claims with

3 a transmitting and receiving antenna (ANT) for receiving
4 the received signal (Rx) and for transmitting a
5 transmission signal (Tx),

6 a receiver arrangement (R) for converting the frequency
7 of the received received signal (Rx) and for detecting data
8 bits from the received signal (Rx),

9 a transmitting arrangement (T) for producing the
10 transmission signal (Tx) from a sequence of data bits to be
11 transmitted at a given bit timing (Tbit),

12 a counter (MC) clocked at a given time clock(Tclk) for
13 producing the bit timing (Tbit) as time distance between
14 successive counter state overflows,

15 a register (L) for taking over the counter state of the
16 counter (MC) each at the time of reception of a data bit
17 and for providing the assumed counter state as counter
18 value (C_i).

1 8. A transmitting and receiving station according to claim
2 7, characterized in that a pulse width modulator (PWM)
3 clocked as per the indicator of the bit timing (Tbit) is
4 provided for producing a binary transmitting data signal
5 (DTx) from the data bits to be transmitted and in that the
6 transmitting data signal (DTx) is supplied to the
7 transmitting arrangement (T) for producing the transmission
8 signal (Tx).

1 9. A transmitting receiver station according to claim 7 or
2 8, characterized in that a switch (SW) is provided, via
3 which the transmitting and receiving antenna (ANT) is
4 conductively connected alternatively with the receiver
5 arrangement (R) or with the transmitting arrangement (T).

1 10. A transmitting receiver station according to one of
2 claims 7 to 9, characterized in that a digital control
3 unit, in particular a microcontroller (μC) is provided for
4 evaluating the counter values (C_i) and for providing the bit
5 information to be transmitted.

1 11. Use of the method according to one of the claims 1 to 6
2 in a keyless locking system for motor vehicles for
3 determining the distance between a first transmitting and
4 receiving station provided in the motor vehicle and a
5 second transmitting and receiving station provided in a key
6 module.